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ARTIFICIAL INTELLIGENCE AND ITS IMPLICATIONS IN PRECISION AGRICULTURE

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Abstract: Artificial intelligence is profoundly transforming agriculture, introducing the concept of precision agriculture. Precision agriculture refers to the use of advanced technologies to optimize crop yields and resource efficiency based on precise observations, measurements and analyses. These technologies allow farmers to make informed decisions and adjust their practices in real time. Artificial intelligence opens new horizons for precision agriculture, offering innovative solutions to increase efficiency and sustainability in agriculture. However, widespread adoption requires addressing cost, skills and data security challenges. Artificial intelligence optimizes the use of resources and reduces costs and environmental impact. Precision agriculture can contribute to more sustainable agricultural practices by reducing the carbon footprint and excessive use of chemicals.

Introduction

- Precision agriculture is a cornerstone of contemporary farming technology. It uses advanced technology to optimise and manage farming operations. Technologies like geolocation, the Internet of Things (IoT), and machines like drones aid producers in managing resources or monitoring plant health and crop yields. It's an essential matter for sustainable agriculture practitioners.
- Agricultural technology and sustainable agriculture research are focal points of many organisations, like the European Union Emerging tech components can hugely contribute to the development of sustainable agriculture practices.
- With recent climate changes, sustainable agriculture has gained a lot of significance. Ecological practices to improve environmental quality and help mitigate climate change are also at the forefront of technology debate.

Material and method

- Smart agriculture can be seen as a management concept that relies on data and insights obtained during research efforts, as well as during agri-food operations. The information can be structured in many different ways and results in decisions; sometimes automatically implementing these into actions towards safeguarding or increasing agricultural productivity and food security under variable physical and chemical constraints in a changing climate.

Results and discussions

- Artificial intelligence is a tool that allows smart agriculture to achieve objectives that are beyond the reach of human capabilities. The processing of a huge amount of data and transforming them into actionable items is one of the challenges for the future.

Figure 1. Promised areas of improvement of agriculture in the exploitation of the data

- In agriculture, improvements are expected or promised in many areas, based on the exploration and exploitation of data when these are available (Figure 1). Cost reductions, crop forecasting, and improved decision-making and efficiency are additional benefits directly benefiting farmers.

Benefits of AI in agriculture

- Nevertheless, innovative ideas are being introduced in every industry, and agriculture is no exception. In recent years, the world has witnessed rapid advancements in agricultural technology, revolutionizing farming practices.
- These innovations are becoming increasingly essential as global challenges such as climate change, population growth together with resource scarcity threaten the sustainability of our food system. Introducing AI solves many challenges and helps to diminish many disadvantages of traditional farming.
- Artificial intelligence in agriculture can help explore the soil health to collect insights, monitor weather conditions, and recommend the application of fertilizer and pesticides. Farm management software boosts production together with profitability, enabling farmers to make better decisions at every stage of the crop cultivation process.

Role of AI in the agriculture information management cycle

Managing agricultural data with AI can be beneficial in many ways:

- **Risk management**. Predictive analytics reduces errors in farming processes.
- **Plant breeding.** AI utilized plant growth data to further advise on crops that are more resilient to extreme weather, disease or harmful pests.
- **Soil and crop health analysis**. AI algorithms can analyze the chemical composition of soil samples to determine which nutrients may be lacking. AI can also identify or even predict crop diseases.
- **Crop feeding.** AI in irrigation is useful for identifying optimal patterns and nutrient application times, while predicting the optimal mix of agronomic products.
- **Harvesting**. AI is useful for enhancing crop yields and can even predict the best time to harvest crops.

Conclusions

- Many people perceive AI as something that applies only to the digital world, with no relevance to physical farming tasks. This assumption is usually based on a lack of understanding of AI tools. Most people don't fully understand how AI in agricultural biotechnology works, especially those in non-tech-related sectors, leading to slow AI adoption across the agricultural sector. Although agriculture has seen countless developments in its long history, many farmers are more familiar with traditional methods. A vast majority of farmers are unlikely to have worked on projects that involved AI technology.
- More importantly, the benefits of AI in agriculture are undeniable. Smart farming tools, intelligent automation, and AI-powered products perform repetitive time-consuming tasks so workers can use their time for more strategic operations that require human judgment. Increasingly affordable computer vision alongside agricultural robotics have the potential to accelerate AI advancement in farming.
- Also, AgTech providers often fail to clearly explain the benefits of new technologies and how to implement them. A huge amount of work must be done by technology providers to help people understand the application of AI in agriculture. Considering the benefits of artificial intelligence for sustainable farming, implementing this technology may look like a logical step for every farmer. However, there are still some challenges to overcome.